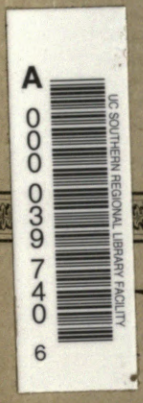


The Eliot School Course

—OF—

MANUAL TRAINING.

JAMAICA PLAIN, MASS.

JULY, 1892.

WEST ROXBURY NEWS PRINT.

Manual Training at the Eliot School.

The introduction of some form of tool work in the earliest stages of education is only an extension of the laboratory method of instruction, which has become nearly universal within the last twenty years in the colleges and technical schools.

Experience has shown that the laboratory training of the higher schools, not only gives experimental skill, but cultivates the imagination, strengthens the judgment and forms habits of accurate thinking; and it is daily becoming more clear that, according as the mind is well or ill trained before it comes to the college work, so is the success or failure of the pupil most probable.

Some of the Trustees of the Eliot School, being intimately connected with one of the pioneer technical schools, it is quite natural that the Board, in common with other thoughtful educators, should consider the introduction of manual training into the grammar schools.

In looking for the best uses to which the Eliot School funds could be applied, the Trustees decided that if the Board could contribute a substantial block of knowledge upon the ways and means of accomplishing the introduction of some form of manual training into the grammar schools, it would not only be benefiting Jamaica Plain boys, but possibly a larger constituency.

A summer class was first started as an experiment in 1881.

The next step was to furnish instruction to classes from the public schools in the vicinity, which, with the permission of the School Board, were attended during the year 1889-90 by the pupils of five grammar schools and one high school. It was intended to give the course to the graduating class only, but it so happened that pupils came from the three upper grades, a fortunate misunderstanding as it proved, since it gave at the outset an opportunity to make a valuable comparison of interest, ability and mental growth in the three classes during the year. In the year 1890-91, the work was given to the second grammar grade

only, the pupils coming from four schools. Beside the classes from the public schools, a private class of very young children was given a course in thin work. During this year and subsequently, the school received from the City of Boston, not only moral support, but financial aid.

In 1891-92, the third year of the experiment, a four years' course was given to the four upper grades of a single grammar school.

It will be seen that the plan outlined in the following pages was perfected as a result of actual experience, and that, whatever its merits, it has been carefully thought out, and the Trustees now place the results before the public in the hope that some substantial good may result.

A Description of the Eliot School Course.

BY FRANK M. LEAVITT.

The Eliot School course in manual training is a course in tool work and drawing adapted to the large classes of graded schools.

It is arranged to be an integral part of the school curriculum and not a side issue, and reinforces the other branches, both directly and indirectly, by making the pupil more careful, thoughtful and methodical in his work.

In its present form it is laid out for the four upper grades of the grammar school, three years' experience of the several classes having convinced us that the best results are to be expected when the whole class is taught together.

The system was originally based on the course of Russian manual training, as introduced by Dr. Runkle, in 1876, in the school of Mechanic Arts at the Mass. Institute of Technology, but has been largely influenced by that modification of Swedish Sloyd for which we are indebted to Mr. Larsson, of the Appleton St. School.

This particular combination is a result of our study of the relative value of exercises as illustrations of principles and of finished pieces, and of the degree of interest felt by the boy in each. We found that the more advanced the boy, the greater his interest in exercises; the pleasures of solving the problem being sufficient in itself to keep up interest, aside from the value of the piece when finished. This state of mind should, however, be led up to by preliminary work.

The relation of drawing and tool work has been one of the most important features of our methods, both being taught as the expression of thought; drawing, like writing, as a means of expressing or recording facts, facts of form and dimension, and tool work as an expression of those facts in material.

The accuracy of mechanical drawing, apart from its own peculiar value, is of benefit to all drawing, educating the eye as it does to nicer measurements of proportion, and the hand to straightforward, unfaltering work. It is at one with all drawing as the expression of facts of form and dimension.

All possible helps to increased power of expression are needed, because the average boy is clumsy (if we may be allowed the word.) His eye is clumsy, he does not see things

correctly, he misjudges form and proportion. His hand is clumsy, when he has done the thing, he cannot tell what he has done. His mind is clumsy, for he neither sees, executes, speaks nor thinks methodically; he is just as likely to do his work first and his thinking afterward, as to proceed correctly.

Our method from the first has been that of class instruction, and by that we do not mean that every boy does the same thing at the same time, like a company of soldiers on dress parade, but that each exercise is demonstrated to the whole class, and then each boy is supposed to work the exercises as independently of the teacher as possible. Those finishing before the end of the session are given extra work. We thus get the stimulus of class work.

As has been said, the course is a combination of drawing and tool work.

The drawing has been principally, but not wholly, mechanical or constructive drawing, namely, that done with instruments, T square, triangle, etc.

The tool work deals with the construction, first, of simple pieces, later, with some principles of construction, then with the application of those principles resulting in finished pieces again, and always with the use of the ordinary wood-working tools.

The following is an outline of the work of each grade.

The course being based on a progression of ideas, and not upon a series of definite models, it is impossible to illustrate it fully, but the accompanying plates show the models used in the development of the ideas.

FIRST YEAR OR FOURTH GRADE.

The first year's work is shown in the nineteen pieces of the class known as the fourth grade. In this year drawing is the special feature, light tool work only, being introduced. The thin wood (one quarter inch) eliminates all question of form, other than in two dimensions. A piece of thin stock is fastened firmly to the bench, in such a position that it may be drawn upon by means of the ordinary draughtsman's instruments, T square, triangle, and compasses. The drawings consist of plane figures which are made up of horizontal, vertical, and oblique lines, arcs of circles, and some free-hand curves, and are such as require for their construction a few geometrical problems.

At the beginning of the lesson the model is held by the teacher, who makes the drawing step by step on the blackboard at the direction of the class, in response to the question, "What must be done next?" the pupil being required to express himself

HELIOTYPE PRINTING CO. BOSTON.

ELIOT SCHOOL COURSE—FIRST AND SECOND YEARS—FOURTH AND THIRD GRADES.

accurately. After the pupils have drawn the figure on wood, it is cut out by means of a bracket saw, and finished with a plane and file.

The lesson not only results in a finished piece, but makes clear to the child the meaning of drawing and the importance of accuracy. The pupil thus begins at once to make accurate working drawings from models and models from drawings.

The demonstration in tool work is also given to the whole class at once, and is at first simply a direction and a reason. Of course, individual help is given during the lesson when necessary, but it is preferable that once directed, the child like the man, should learn by experience.

SECOND YEAR OR THIRD GRADE.

The second years' work is shown in the nine figures under the third grade.

The drawing of the second year continues all the principles and practices of the first year, and introduces thickness with its necessary additional views. When the piece is of thick wood (as in figure 3-5) the drawing is done in exactly the same way as during the first year, except that the pupil is led to greater independence. When, on the other hand, the piece is to be cut from thick stock (as in figure 3-6), two views are drawn on the thin wood and these are cut out and used as templates, or patterns, in working out the real piece. The pupil thus learns what top, front and side views really are.

The tool work introduces more and larger tools, making a special feature of the form work.

THIRD YEAR OR SECOND GRADE.

The third year's work is shown in the ten figures of the second grade.

The more practical methods in both drawing and tool work are here introduced. The two are here separated for a time, the pupil making on paper correct working drawings simply as illustrative of principles, and in tool work, executing various exercises from prepared drawings, and using for marking out the rule, square, gauge, and bevel, that is the ordinary tools used by the mechanic for that purpose. The drawing and tool work are at length brought together again, the pupil making in the school room the working drawings of the models he is afterward to make in the shop. This temporary separation of the drawing and tool work, while not absolutely necessary, is thought advisable for the following reasons: The subjects are now to be presented to him in a new light, the drawing as a means of expressing to some one else facts of form and dimension necessary

for the construction of the piece, the tool work as the expression in wood of facts some one else has expressed in drawing. Then, too, the whole subject of putting on dimensions must be taught; that is, of expressing accurately all the facts about the model, though the pupil, by reading the drawings for the two previous years, has unconsciously been learning this most important branch. He has been learning how to express himself in drawing by seeing his teacher draw, as he has been learning to express himself verbally by hearing his teacher talk.

FOURTH YEAR OR FIRST GRADE.

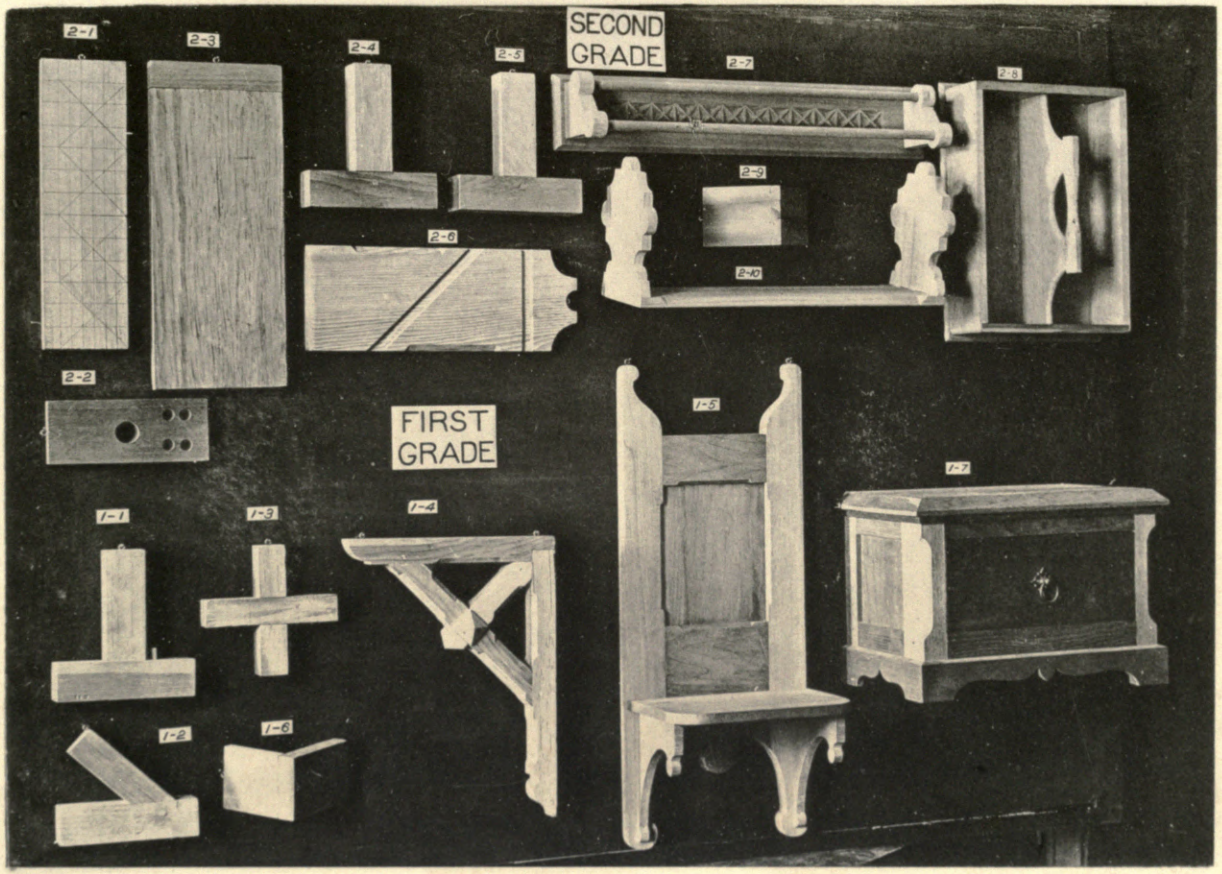
The work of the fourth year is shown in the seven figures of the first grade.

The tool work illustrates further principles of construction, and brings the whole course into harmony and unity in the two finished pieces, the construction of which involves a familiarity with all that has gone before. These pieces are made entirely from the pupil's own drawings and these are made in four ways: First, from models with blackboard instruction; second, from models only; third, with a written description with one model to make the meaning clear; and fourth, from a written description only, being thus purely the expression of thought.

It will be evident to any one who has followed the course thus far that while each year's work of seventy hours can readily be given independently of the rest, yet that there is a very distinct advantage in having the whole given in consecutive order, that the greatest possible benefit may be derived by the pupils for the time spent.

In conclusion, we will recapitulate the aims we have had in view.

To plan a course, helpful in every possible way to the mental and moral development of the child, giving him confidence in his own power of expression and of execution, and to make it such that it could be successfully carried out with the large classes of the grammar school. How far we have succeeded in attaining our ideal, the experience of other teachers must determine.



HELIOTYPE PRINTING CO. BOSTON.

ELIOT SCHOOL COURSE—THIRD AND FOURTH YEARS—SECOND AND FIRST GRADES.

A paper read at the Conference on Manual Training, Boston, April 9, 1892.

Manual Training as an Inspiration to Mental Development.

BY ROBERT H. RICHARDS.

In discussing manual training before you today, I do not indulge in the hope that I shall be so fortunate as to say anything that is new. I believe, however, I can attack this problem from an entirely different standpoint from that taken by others; namely, as a representative of one of the class of boys to whom manual training would have been an especial boon, had it been developed thirty-five years ago.

My paper will therefore begin with manual training as an inspiration to mental development, and, since my name has been honored by the first place on the list in the present programme, I think it will be quite proper for me to say a few words upon the following topics also: "The Choice of Materials for Manual Training," "The Definition of Trade-schools," and "Manual Training Schools both Swedish and Russian, and the Use of them."

I feel still further that I have sufficient reason for speaking of these in the fact that people's minds always drift toward a trade-school, whenever tool-work is spoken of. We cannot, therefore, too often emphasize the statement that manual training is intellectual training,—teaching the child how to think.

I will now take the liberty to refer to such portions of my own personal history as seem to bear upon manual training as an inspiration to mental development.

Up to twenty-one years of age I was the dunce of every school I attended. But, while I was doing nothing with books, my mind was always active. I was actively interested in learning about nature, and boys' out-of-door sports. I well remember the labor that was expended upon me to try to teach me how to read. My teacher put the book upside down in front of me, and left me half an hour. She then returned, and said, "Robert, are you studying?" I answered, "Yes, as hard as I can." She pointed to the book, which was still upside down. I cried when I found how I had deceived her. How, then, could I have told her such a lie, when I believed I was telling her the truth? My answer is that there was an obstacle between me and the reading which was invisible to the teacher and indescribable by me.

Various attempts were made to give me a good start at school

in this country, and later in England, with little success from the school-teacher's point of view. At fifteen years of age, while living in the south of England, a Cambridge University man was engaged as private tutor to myself and brother. He *made* me study, and he made me recite. By his will he forced me to overcome the barrier between me and my lessons. After lessons he read Grimms' "Household Tales" to us, and other stories which fired the youthful imagination. He took us long walks to the woods, the fields, the swamps, and the streams. We named all the wild places we visited, from the incidents he had read to us. I remember today where Philip Slingsby slew the dragon. We also watched the habits of birds and insects, and many an interesting fact was stored up in this way.

At the end of the year we went to school at Wellington College, a school modelled on the lines of Rugby. All personal pressure was removed, and now, as formerly, my lessons were never learned. The same barrier, the same missing link, was between me and my books; and the promise to my mother that I would do my very best was of no avail, on account of it. At this time I learned to be a pretty good cricketer and foot-ball player; but my ramble in the woods, by the streams and lakes, over the heather, watching the habits of birds and animals, collecting insects, were my chief delight.

The custom of the school was to hold out prizes as inducements to the boys to work, the dead languages not having sufficient attraction even for the bright boys. I earned one prize by good conduct at drill; and when my master, for whom I had a warm regard, invited me to select my prize, he having just pointed out a Longfellow or a Shakspere to a bright boy who preceded me, said to me, with almost a sneer, "Here is a book on toads and frogs; I suppose *you* will like that," I took the book with my teeth shut and my fists clenched, when I felt the sting of his remark, which showed me that, in his opinion, if I was learning anything at the school, that something was beneath his consideration.

At nineteen years of age I went to Phillips Academy at Exeter, N. H., and while there I studied as hard as I have ever studied. It was, however, wholly up-hill work, and I remained at the foot of my class, in spite of my efforts. While in England I did not study, because my mind was on other things. When at Exeter, I tried hard to study, and failed because no comprehensible reason could be given me for the study of the dead languages. I never could see the use of Latin and Greek, and no teacher was able to make their use plain to my mind. The answer always came to me, "I tell you it is good for you, and you must do as I tell you."

When twenty-one years of age, I finally went to the Massachusetts Institute of Technology. The school was just opened. There were six other pupils besides myself. With them I immediately began the study of chemistry, geology, mineralogy, surveying, physics, and drawing by laboratory field work, accompanied by lectures. Almost the very day I reached the Institute the scales began to drop from my eyes, and I began to see for the first time what a school was for, and that its main duty was not to worry slow boys. I began to see that French and German were of use, because they told me how my laboratory work was to be done, and why it was to be done so. Chemistry opened my eyes to the wonderful labyrinth, ever widening in all directions, of that department of nature. Physics enchanted me with its wonderful and varied range of phenomena. In fact I found that the new school was teaching me nature, which I had been learning how to love and to study all my life, was teaching me nature by direct contact, and that mathematics, language and history were nothing but means to the end. The whole aspect of school life was at once inverted. I now studied because I could not help it, while I had previously studied because I knew I ought to want to study. My barrier was gone, and why? I was now converting, not print, but observation, into thought, and thoughts into acts (drawings, experiments, field-work.) My books became merely a tool to help me convert observation into thought. The use of books being at last found out, I could not read or study enough to satisfy my craving for knowledge, experience and skill.

I think at the time I told that lie about my lesson that I was designing a culvert for my little road that I had made, on which I drove my toy carriages. I am still troubled with my mind wandering off from the business in hand. I had, while I was writing this very paper, an idea strike me which interfered seriously with my work upon the paper. I had to work it out before I could leave it; and the result of it is I have invented a new objective for a surveying instrument, which looks now as if it would become quite an important addition to the plane table and stadia work of the civil engineer. This absent-mindedness is a very troublesome quality to have.

Soon after graduating from the Institute, President Runkle placed me in charge of the designing, equipping, and managing the new mining laboratory of the Institute. I knew only the little that a graduate from a very imperfect course in mining and metallurgy might be expected to know, and that hampered by the fact that I was naturally slow at books. I once heard Professor Runkle remark "How wonderful it is that Richards should have such an aptitude for designing apparatus and arranging the

practical side of this mining course!" Professor Runkle did not know that I had spent the first twenty-one years of my life in learning how to observe, and that, however little guided, however unsystematic, however much looked down upon by my teachers for doing it, I had gained a great deal; and the gain that I had made was beginning to show in results.

I do not know how to account for my extreme difficulty in learning. I have heard no physiological theory to explain it. I think, however, that it is in this way: the step one takes in converting the printed page of a book into thought is a very wide leap, probably the widest leap a child ever has to make. If I were told to jump a stream twenty-five feet wide, I should not even try to do it, knowing the jump impossible; but, if stepping-stones were put in, three feet apart, I could cross the stream with ease and pleasure. I think the Institute of Technology put in the missing stepping-stones, and converted the study which had always been to me a hated task, done only from love for my mother, into an active, living, and intense interest.

Now, how could this be? How could one school make ideas so clear, when another school had not done so? Let me see if I can answer this question. If I convert a page of print into thought, I require to read the page perhaps several times, making notes as I go, taking me some minutes, perhaps hours, to understand it. If I convert a working drawing into thought, I glance at it, again a second time—yes, I understand perfectly. Seconds only are required. The written description of an object that would take ten minutes, perhaps hours, to understand, is acquired more perfectly by a few seconds from the drawing. In fact, drawing is a separate language by which ideas are conveyed with but a very small expenditure of time and effort, compared with print. But, still better, it is a universal language. The American can talk to the Russian by a drawing as fluently as though they had been born and bred in the same country. Drawing becomes, therefore, a means of cultivating the intellectual faculty, and we must now consider how it can best accomplish this end. Free-hand sketching is good. So also is mechanical drawing. They cultivate the hand and the eye to accurate observation and reproduction, as well as the eye for beauty.

The act of making objects by copying from a like model does the same thing. But when a child makes a drawing from an object, and then makes an object of that drawing, he has derived not only the advantages from both, but he has done a great deal more: he has found out the use of one of the greatest tools of modern progress,—namely, a working drawing. The working drawing is, in my opinion, the grand central idea around which all the practical hand-work of the school should be crystalized.

Later I expect to demonstrate the fact that a course can be so laid out as to lead the boy gradually to a perfect understanding of it.

I do not think my experience is extraordinary or unique. I fancy every school has in it just such boys as I was. For them this new scheme of object-teaching is of the highest importance, as it gives them the stepping-stones so much needed. On the other hand, for the bright boys, the new system serves to give them a chance to measure themselves alongside of their neighbors by some other standard than their speed of converting print into thought; and it gives them a chance to see that there are some things in the world to be done that require a little care, a little time, a little thought, and a little patience, all of which are most excellent lessons for the bright, swift thinker to learn.

I heard a master of one of the public schools of Boston, whose pupils were taking a course in wood-work at the Eliot School in Jamaica Plain remark that he had a number of dull boys that he could do nothing with. Shortly after the carpentry began they suddenly seemed to open out and understand what their lessons were for.

In my teaching at the Institute of Technology, I have had instances of boys, the finest and brightest from the usual teacher's standpoint, who, while they could outrank all their neighbors in the school, have taken longer and found it harder to adapt themselves to the world's demands than any others.

So far for my reasons why I favor manual training. I will now go to the materials and the course of instruction.

If now we admit that some experience with things, some chance to cultivate observing, recording, collating, and the drawing of conclusions, is good for boys, whether they are quick or slow, whether they are good or bad, how shall we choose a scheme of things? How shall we choose a material for the course? Here we are, crowded into great cities. We cannot use the country fields, woods, streams, etc., or even the country blacksmith's shop or carpenter's shop; our numbers are too great, and the country too far away. Natural history is largely ruled out, and experimental science is too abstruse and also expensive. We come down to the making of objects as the simplest and most available plan.

In choosing material, we shall have to rule out most of the trades, as the special machinery and materials used cost too much. We naturally come to the common materials of construction, wood, cast iron, wrought iron. These seem to answer the purpose from both points of view—cheapness and availability—better than any others. All houses and buildings, as well as engineering construction, are largely, if not wholly, made of

these materials. It is difficult to imagine a person so placed that a knowledge of the properties of the three great construction materials—wood, wrought iron, and cast iron—should not be of great value to him, whether he be a laborer, a politician, a watchmaker, a lawyer, an engineer, a physician, or a minister. If, then, the child can obtain a practical knowledge of the common materials and tools of daily life while he is getting his intellectual training from them, how much greater the benefit of the course! So much for the materials.

Permit me now for a few moments to consider the schemes of instruction that are before the public.

There are two principal ways of teaching the properties and modes of using materials. One is called the trade-school. The other is called the manual training school; and of this there are two varieties now before the public—Swedish manual training, or Sloyd, and Russian manual training.

How shall we apply this system of tool-work? Shall we adopt a trade-school, a Swedish manual training, or a Russian manual training school? The newspapers are talking about all of these different schools. Which shall we adopt for our Boston boys and girls?

In order to answer this question we shall have to see what the difference is between these systems.

First, let us consider the trade-school. Here the pupil must be taught upon life-size scale. The pieces he works upon must be as large as they would be in practice. The stock will be a great expense. To pay for this, we must have the boy make a large number of any one article that he has learned how to make in order that the expense of his early clumsiness may be paid for through his later skill by the sale of the articles he has made. The school, then, must become a factory, of which goods, and not boys, are the principal products. That alone is enough to condemn trade-schools for boys and girls. The main object for which a taxpayer supports the public school is that the boys and girls may be educated to the best advantage, not that the doors, and bedsteads, chairs, etc., that the school produces, may be saleable.

Again, suppose, in our public schools, where we may have the children one-half day per week on manual training, we tried to teach the trade of carpentry. We will say that we start the class in making chests of drawers, in September. They require the first month to make the first dovetailed corner of the first drawer. The dovetails are horrible to look at. The next month perhaps, they make the other three dovetails of the first drawer, each one better than the last; but the drawer will not lie down flat: it is up at one corner and down at the next. Each new

piece the boy makes better than the last; and, if he has been so fortunate as to get through his chest of drawers at the end of the year, it will not be a satisfactory job,—it will be a history of his advancing skill, beginning with the poorest workmanship at one corner, going on until the last degree of skill was obtained. He will have worked all the year with his early failures staring him in the face, and telling him that his year's work must be a failure, however hard he may try. The fact is, the time is too limited to make him a carpenter, even if we wished to make him one, which we do not.

Let us now look at a trade-school from another point of view. If we put in a shoemaking course in the public schools, we may either have a good, enthusiastic teacher or a poor, indifferent one. If the latter, the course would amount to nothing, and had better be left out; but, if the former, observe the consequences: all the children would rush into the course. This course would be the largest and most popular of all the elective departments. The city would soon be flooded with young, only partly fledged shoemakers; and then the trades-union would step in, and the imperial voter would say, "Stop! we can't have this."

Again, observe that the masons' trade would say to City Hall, "We refuse to pay taxes to support a shoemakers' school, when you do not give us a masons' school to teach our boys." Whichever side of the fence the voter is, he has a well-defined case for grumbling.

We may say, then, for lack of time, from high cost, from political reasons, from total inappropriateness, a trade-school is not suitable to the public school system for boys or girls.

Professor Runkle tells me that this trade-school idea was tried at the great Technical School at Moscow from about 1844 to 1868, that it failed through that whole period to produce the effects sought, and that in 1868 the Russian manual training in wood was first started, which has since that time produced such wonderful results in brightening up dull boys and in ballasting bright boys. There are places for trade schools, and they have their uses. For instance, in a large city like New York, there are many paupers, some of them, perhaps most of them, supported by charity or in the reformatory. There are some of them, however, who, if they were given a trade, would go to work and earn their living, and be glad to do it. A trade-school for nearly or quite grown up men under those circumstances, if discreetly managed, will be a success.

Again, a trade-school is quite in place where a large firm or company find they have a deficit of a certain class of skilled labor, and it is cheaper and better to educate them than to import. In certain districts of England and Germany, where the whole town

is devoted to one kind of manufacture,—as weaving, for instance,—very successful trade-schools exist. They fill a very important want, and do not flood the market, because the market is so very large.

We now come to the various kinds of manual training, of which the Swedish and the Russian manual training are the two most prominent examples. These systems do not strive to teach any trade at all. They strive to teach the principles which underlie all trades. They bear the same relations to trade-schools that the modern inductive scientific method of thought does to the old rule-of-thumb method,—do this because your grandfather did it so. If it was good enough for your grandfather, it is good enough for you.

Manual training is part and parcel of the great modern movement which is coming into everything; namely, observe, record, collate, conclude. And, so long as this mental faculty is seized upon and developed in the child, I do not care whether he makes a complete chest of drawers or only one corner of one drawer. It is the boy we are making, not furniture.

Let us now make an analytical comparison between the Swedish and Russian methods. The Swedish makes finished articles. The Russian makes mainly typical pieces, with only an occasional finished piece. They are both progressive; that is, advance by steps from simpler to more complex. The Swedish selects its course from the small wooden articles used in the house and garden. It teaches symmetry of form. The Russian selects the various fittings used by the carpenter in building and furnishing a house. It teaches exactness of fit. The pieces judge themselves. The Swedish seeks to please the child by the value of the article he carries home, and to develop him by progressive steps in tools and work. The Russian seeks to awaken a child by preliminary work, and to charm him by his own development. The Swedish uses the drawing only on the piece. The Russian uses the working drawing independently of the piece. The Swedish is accepted by all children of ten years: it is a delight to them, and there is no difficulty in keeping up their interest during the early stages. The interest, however, can hardly last through a series of years. The Russian is apt to flag a little at first, with boys of even twelve years, before the effect has been produced and the idea absorbed; but, as soon as the child's mind has begun to react, advancement is a delight to both teacher and pupil. Pupils who at the start clamored for finished pieces come later and say: "I was mistaken, you knew best." "I am satisfied the course is much better than if I were making finished pieces."

As to the appropriateness of one or another course, I think we may obtain some light in this way: A child needs the incentive

of the finished pieces when he is young,—say ten to twelve years. On the other hand, the introduction of working drawings and the exercise of the intellectual faculty of thinking out how intricate mortises and other fittings can be made, while they would fall flat on a child of ten to twelve years old, are thoroughly appreciated and profited by in the case of a child thirteen to fifteen years,—the older, the more so. Therefore, we find in the very principles which control each of these systems the strongly indicated opinion that the Swedish should come earlier, say ten to twelve, and the Russian later, say thirteen to fifteen.

Having now compared the Swedish and Russian methods, what are we to advise? Clearly, we need them both. Shall we take them unchanged as they are from abroad? Let us look at experience. Can any foreign manufactory succeed in this country without proper adaptation? Answer, No, never. Can any foreign institution be imported without change, and succeed in this country without at first being adapted to the genius of our people? Answer, No, never. There is clearly here a double reason for adaptation. The two schemes will both need to be adapted to our country, but they must also be adapted to each other. For instance, we may look for the weak and the strong points of each system, and then see if we cannot so weld them together that the strong points of the one system supplement the weak points of the other. I think a little welding or splicing between the ends of these two courses will be found to remove the weak points of both, and as a result, give us one continuous whole, strong at every point, which will hold the interest and enthusiasm of the pupils throughout the last four years of the grammar school. In order to put this question to the test, let us place Swedish sloyd in the grammar school curriculum, between ten and twelve years, and the Russian between thirteen and fifteen years.

Now, let us see where the weak points of the two systems are. We see at once that toward the end of sloyd the pupil's interest is liable to wane, and at the beginning of the Russian the working drawing is uphill work and hard for the child at first. How can these two weak ends which come together be welded so as to mutually strengthen each other? This can be done by making the working drawing the grand final climax toward which both these courses lead.

Suppose, for instance, that sloyd be asked to recast its progressive order, which is now done upon a principle which in idea, but not in fact, may be expressed by saying:—

Lesson one, whittle on one side of a stick, one surface.

Lesson two, whittle on two sides of a stick, two surfaces, one edge.

Lesson three, whittle on two sides and end of a stick, three surfaces, three edges.

Lesson four, use knife and file on a stick.

Lesson five, use knife, file, and sandpaper on a stick; and so on, adding an exercise or a tool at every new piece.

Let the course as it now is to be recast around the central idea or a final working drawing. To do this, place together for the eleven-year-old boys all the pieces which work upon *two-dimension stuff*, say one-fourth inch thick. The boy draws his piece upon the wood, making the simple horizontal projection of it. Let the pieces be so laid out that the work will be progressive in every sense that Swedish work is progressive. The pupil will here learn to draw plane pieces, and to cut them out accurately, and to make finished objects by combining them; and, over and above all the other benefits of the course, he will acquire the idea of the *plan* of an object; we may call this two-dimension work.

The twelve-year-old pupil is given *three-dimension work*, on thicker stock. He draws sections on the face, the side and the end of the piece, and then works down to the finished shape. For this purpose ,all of the sloyd pieces suitable for this work are arranged in series, going from simple to more complex. During this year he has learned the idea of the *plan*, the *elevation* and the *end view* of the object, but does not yet know that he has learned them.

The thirteen-year-old pupil now begins the Russian course with his drawings, the difficulty of which has entirely vanished because his two previous years have led him up to it. He has been learning the principles of the working drawing without knowing that he was learning them. The difficulty at the beginning of the Russian scheme is therefore entirely removed.

The sloyd pieces that call out the artistic qualities of the child may be suitably interspersed throughout the course without conflicting with the working drawing idea. Perhaps the greatest charm of all in this manual training is the case in which a child may be brought, at stated stages in his advancement, to attitudes where he knows more than he thinks he does. The discovery which follows is a very great delight and incentive to progress.

The Russian set of pieces has already been worked out for a two years' course, and it will therefore provide for the remainder of the grammar school curriculum.

We have thus reached a finished working drawing as the climax toward which the four years have been systematically tending, and which is not only one of the greatest tools of modern progress, but also is a new mode of thought expression,

a universal language. There is no reason why a fourteen-year-old boy who has been through these four years should not understand an ordinary simple working drawing as well as an engineer of thirty years does now, and he has been gaining besides all the advantages of the tool course; namely, skill, accuracy, throughness, and mental power throughout the entire course.

In conclusion, I wish to say, I do not claim originality for anything contained in this paper. The ideas are all in the very air we breathe. Perhaps of all the friends to whom I am indebted, I am more so to Profesor Runkle and Mr. MacAlister, both of whom have helped me greatly. I wish also to mention Mr. F. M. Leavitt of the Eliot School in Jamaica Plain, who has been the living, connecting link between me and manual training for the last two years. Many of his ideas are embodied in this paper.

Finally, I wish to say that, while it may have seemed to outsiders that Boston was not progressing as rapidly as other cities in these matters, there has not been a time since the first school was opened in 1876 till the present moment when there has not been pioneer work going on in these lines; all of it has been in the right direction, and all of it good. It may not be, any of it the exact final scheme which the city shall adopt; but it has been ploughing the furrow, and sowing the seed, which is to give Boston a good system, and, while doing so, it has been for the boys who have received the training an inspiration to mental development in a degree that words can hardly express.